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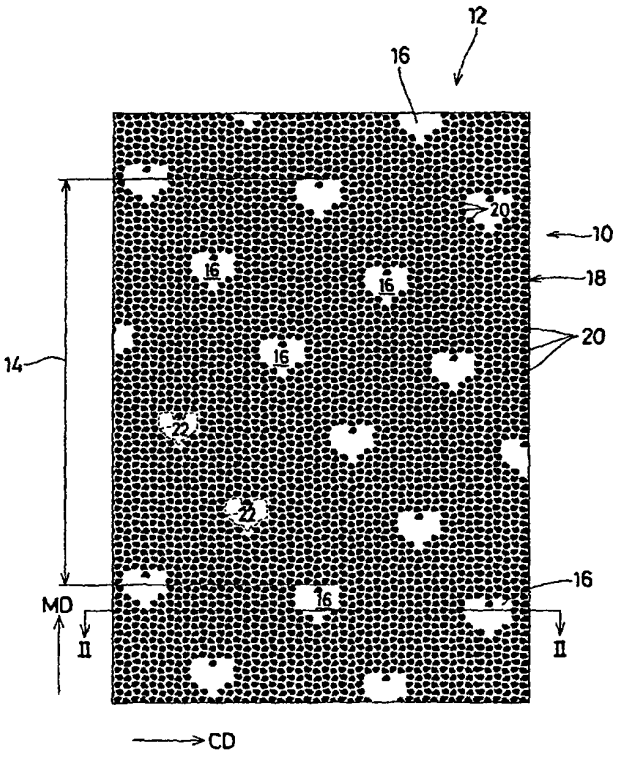
(54) Title: CELLULOSIC FIBROUS WEB HAVING EMBOSSED PATTERN



(57) Abstract: A cellulosic fibrous web having an embossing pattern is disclosed. The embossing pattern comprises a repeating pattern. One repeating pattern comprises a plurality of discrete, distinctive lands and a background matrix having a plurality of discrete elements. The repeating pattern is provided by embossing the cellulosic fibrous web. The background matrix has a density of from 40 to 90 of the discrete elements per square inch. The discrete, distinctive land is defined by being substantially surrounded by the discrete elements of the background matrix. One discrete, distinctive land corresponds to the size eliminating from 4 to 90 of the discrete elements from the background matrix. The total area of the discrete, distinctive lands in one repeating pattern occupies from 3 % to 35 % of the area of one repeating pattern.

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CELLULOSIC FIBROUS WEB HAVING EMBOSSED PATTERN

FIELD OF THE INVENTION

The present invention relates to cellulosic fibrous web, particularly a cellulosic fibrous web having an embossed pattern. The embossing pattern provides an aesthetic appearance and bulk for the cellulosic fibrous web.

BACKGROUND

Cellulosic fibrous web, such as tissue products, are in almost constant use in daily life. Toilet tissue, paper towels, and facial tissue are examples of cellulosic fibrous web used throughout home and industry. Although such a cellulosic fibrous web which remains unaltered from the base sheet has been long accepted by consumers, there is a need for cellulosic fibrous web having an aesthetic appearance. The aesthetic appearance of the cellulosic fibrous web gives consumers the impression of high quality products. It is also desirable to impart the cellulosic fibrous web bulk. The property of bulk is desirable for high quality products because it is associated with softness and absorbency from consumer standpoint.

A number of approaches have been attempted to improve aesthetic appearance and bulk of the cellulosic fibrous web. For example, embossing patterns are common to impart aesthetic appearance and bulk to the cellulosic fibrous web. Considerable efforts have been directed to embossing cellulosic fibrous web. For example, U.S. Patent 5,562,805 issued to Kamps et al. on October 8, 1996 discloses a method for making soft high bulk tissue. The tissue is embossed with a fine scale embossing pattern to increase

bulk and a minimal loss in strength. The fine scale embossing pattern contains at least about 15 discrete intermeshing embossing elements per square centimeter (100 per square inch).

US. Patent 5,300,347 issued to Underhill et al. on April 5, 1994 discloses an embossed facial tissue. The uniformly embossed facial tissue has a continuous or closely-spaced discontinuous embossing pattern. The lines of embossing pattern leave the unembossed pillow surrounded by the lines of embossing relatively bulky. The tissue has from about 1 to about 40 distinct individual unembossed areas per square inch of tissue.

U.S. Patent 4,759,967 issued to Bauernfeind on July 26, 1988 discloses an embossing process and product. A majority, and preferably substantially all, of the background embossments have major and minor axis. The major axis is substantially aligned in the CD of the sheet. It also discloses the background embossing pattern which essentially covers the sheet and an additional intermittent design pattern. The additional intermittent design pattern is formed by unembossed neutral plane.

U.S. Design Patent 362,967 issued to Rothwell et al. on October 10, 1995 and U.S. Design Patent 371,910 issued to Schultz et al. on July 23, 1996 disclose embossed paper products. These embossed paper products have relatively coarse embossments and unembossed region having relatively large area in the embossed pattern.

There is an increase in consumer needs for longer life of the product, hence, a higher number of sheets on a given roll diameter or in a given size of box while maintaining bulk of the sheet. One approach to achieve increasing the number of the sheets at a given roll diameter or in a given size of box is maximizing nesting of the embossed sheets. However, fine scale embossments provided on the sheet are difficult to nest one another due to its fine scale of the embossments, thereby hindering the sheets from nesting. On the other hand, large scale embossments relatively easily nest one another compared with fine scale embossments. However, when the sheets are piled or wound, large scale embossments easily collapse, hence lose bulk.

Further, it is desirable to impart aesthetic appearance on the web by a simple operation. One approach to achieve it is arranging the embossments to form a desired pattern, e.g., by remaining a predetermined area of the cellulosic fibrous web unembossed, thereby forming a design pattern by unembossed plane. Remaining many portions of the cellulosic fibrous web unembossed may impart more aesthetic appearance

for the web. However, too many unembossed areas on the cellulosic fibrous web disrupt the nesting of the sheets when wound in a roll or piled in a box. This causes product issues such as ridging and/or wrinkles on the surface of the roll product or the product filled in the box.

Thus, there is a need for a cellulosic fibrous web that is bulky and has aesthetic appearance on the web. There is also a need for a cellulosic fibrous web adapting to longer life of the product. There is also a need for reducing ridging and/or wrinkles on the surface of the final product.

SUMMARY

The present invention relates to a cellulosic fibrous web having an embossing pattern. The embossing pattern comprises a repeating pattern. One repeating pattern comprises a plurality of discrete, distinctive lands and a background matrix formed by a plurality of discrete elements. The repeating pattern is provided by embossing the cellulosic fibrous web. The background matrix has a density of from 40 to 90 of the discrete elements per square inch. The discrete, distinctive land is defined by being substantially surrounded by the discrete elements of the background matrix. One discrete, distinctive land corresponds to the size eliminating from 4 to 90 of the discrete elements from the background matrix. The total area of the discrete, distinctive lands in one repeating pattern occupies from 3 % to 35 % of the area of one repeating pattern.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which:

FIG. 1 is a plan view of a cellulosic fibrous web having an embossing pattern;

FIG. 2 is a cross-sectional view of a cellulosic fibrous web shown in FIG. 1 taken along a II-II line;

FIG. 3 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 4 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 5 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 6 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 7 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 8 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 9 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 10 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 11 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 12 is a plan view of a cellulosic fibrous web having another embossing pattern;

FIG. 13 is a plan view of a cellulosic fibrous web having another embossing pattern; and

FIG. 14 shows a schematic view of an embossing process to produce the cellulosic fibrous web in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

"Comprising" means that other steps and other elements which do not affect the end result can be added. This term encompasses the terms "consisting of" and "consisting essentially of".

FIG. 1, which is a plan view of one example of an embossing pattern for use in the present invention, is referred to detail the present invention. The embossing pattern 10 is provided on a cellulosic fibrous web, such as toilet tissue, paper towels, and facial tissue. In the embodiment shown in FIG. 1, the embossing pattern 10 is provided on a tissue 12 wound in a roll (FIG. 1 shows only a portion of the tissue unwound from the roll). The tissue 12 extends in two directions; machine direction MD and cross machine direction CD. Herein, "machine direction", designated MD, is the direction parallel to the flow of paper through the papermaking equipment. Herein, "cross machine direction", designated CD, is the direction perpendicular to the machine direction in the X-Y plane.

The embossing pattern 10 has two or more of a repeating pattern 14 repeating in the machine direction MD. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18. One repeating pattern in MD can be determined by comparing contiguous patterns having the same length in MD. When the contiguous patterns having the same length in MD are the same along the MD of the product, the pattern is a repeating pattern. One repeating pattern in CD may be determined as a width of the product. Therefore, the area of the repeating pattern can be defined by the length in MD of one repeating pattern of the product and the width in CD of the product (i.e., (area) = (length in MD of one repeating pattern of product) x (width in CD of product)). The background matrix 18 is formed by a plurality of discrete embossed elements 20 which are shown as a black element in FIG. 1. The discrete, distinctive land 16 is defined by being substantially surrounded by a plurality of the discrete embossed elements 20. Herein, "discrete" means that the adjacent elements are not contiguous with each other. In the embodiment shown in FIG. 1, the adjacent embossed elements 20 are not contiguous with each other. Herein, "distinctive" means that the land is discernible and distinguishable from the background matrix. Herein, "substantially surrounded" means that the land is surrounded by a plurality of discrete elements which do not form a closed line (i.e., the land is not surrounded by a closed line). In the embodiment shown in FIG. 1, the discrete, distinctive land 16 is rendered discernible and distinguishable from the background matrix 18 by not having discrete embossed elements 20 therein. Preferably, the discrete element 20 and the discrete, distinctive land 16 are of relatively different level in height as a result of embossing. Referring to FIG. 2 as well, the discrete element 20 is preferably embossed, and the discrete, distinctive land 16 is preferably unembossed. Alternatively, the discrete, distinctive land 16 may be embossed to be still of different level in height from the discrete element 20. Alternatively, the discrete element 20 and the discrete, distinctive land 16 are of the same level in height as long as

the discrete, distinctive land 16 is discernible and distinguishable from the background matrix 20. In further alternative embodiment, the discrete element 20 may not be embossed, and the discrete, distinctive land 16 may be embossed. In this case, in order to render the discrete elements 20 discernible, the remainder of the background matrix 18 other than the discrete elements 20 may be embossed (in the embodiment shown in FIG. 1, the remainder of the background matrix 18 is shown as a white network-like element).

The background matrix 18 is formed by a plurality of discrete elements 20. The background matrix 18 preferably has a density of from 40 to 90 of the discrete elements 20 per square inch, more preferably from 45 to 80 of the discrete elements 20 per square inch, most preferably from 50 to 70 of the discrete elements 20 per square inch. It is preferable that the background matrix 18 has a density of not less than 40 of the discrete elements 20 to sustain bulk of the tissue 12. It is also preferable that the background matrix 18 has a density of not greater than 90 of the discrete elements 20 to provide efficient nesting between the sheets.

The discrete element 20 preferably has the area of from 0.006 $inch^2$ to 0.024 $inch^2$, more preferably from 0.009 $inch^2$ to 0.020 $inch^2$, most preferably from 0.010 $inch^2$ to 0.017 $inch^2$. The discrete element 20 may have any shape, such as circle, oval, dot, rain drop, hexagon, bow tie, and trident. In the embodiment shown in FIG. 1, the discrete element 20 has a rain drop shape.

The discrete, distinctive land 16 is defined by being substantially surrounded by the discrete elements 20. In the embodiment shown in FIG. 1, the discrete, distinctive land 16 is surrounded by about twenty of the discrete elements 20. These discrete elements 20 are disposed discontinuously surrounding the discrete, distinctive land 16. Although the discrete, distinctive land 16 is not surrounded by a closed line, the discrete, distinctive land 16 can be viewed as forming a shape surrounded by an outline shown by a dotted line 22 in FIG. 1. The dotted outline 22 is substantially surrounded by a plurality of discrete elements 20 and defined as a boundary between the discrete, distinctive land 16 and a plurality of discrete elements 20. The discrete, distinctive land 16 preferably has the size corresponding to the size eliminating from 4 to 90 of the discrete elements 20 from the background matrix 18, more preferably the size eliminating from 8 to 70 of the discrete elements 20 from the background matrix 18, most preferably the size eliminating from 10 to 60 of the discrete elements 20 from the background matrix 18. It is preferable that the discrete, distinctive land 16 has the size eliminating not less than 4 of the discrete

elements 20 so that the discrete, distinctive land 16 is recognizable and clear to the consumers for aesthetics. It is also preferable that the discrete, distinctive land 16 has the size eliminating not more than 90 of the discrete elements 20 so that the unembossed discrete, distinctive land 16 does not disrupt the nesting of the tissue sheets when the sheets are wound in a roll or piled in a box.

The total area of the discrete, distinctive lands 16 in one repeating pattern preferably occupies from 3 % to 35 % of the area of one repeating pattern, more preferably from 6 % to 28 % of the area of one repeating pattern, most preferably from 10 % to 24 % of the area of one repeating pattern. It is preferable that the total area of the discrete, distinctive lands 16 in one repeating pattern occupies not less than 3 % so that the discrete, distinctive land 16 is recognizable and clear to the consumers. It is preferable that the total area of the discrete, distinctive lands 16 in one repeating pattern occupies not more than 35 % so that the unembossed discrete, distinctive land 16 does not disrupt the nesting of the tissue sheets when the sheets are wound in a roll or piled in a box.

The discrete, distinctive land 16 preferably has the area of from 0.025 $inch^2$ to 3.3 $inch^2$, more preferably from 0.076 $inch^2$ to 2.6 $inch^2$, most preferably from 0.125 $inch^2$ to 2.2 $inch^2$. Herein, the area of one discrete, distinctive land 16 is determined by the total area of the discrete elements 20 eliminated. The outline 22 of the discrete, distinctive land 16 may have any shape, such as circle, oval, square, triangle, diamond, rectangle, hexagon, heart, flower, pound, wavy diamond, wavy square, and wavy rectangle. In the embodiment shown in FIG. 1, the outline 22 of the discrete, distinctive land 16 has a heart-like shape.

The repeating pattern 14 may have at least one discrete element 24 remained inside of the discrete, distinctive land 16. The repeating pattern 14 may have a plurality of discrete elements 24 remained inside of the discrete, distinctive land 16. The discrete element 24 remained inside of the land 16 provides more aesthetic impression to the consumers. Referring to FIG. 3, each of the discrete, distinctive land 16 has a plurality of discrete elements 24 remained without being eliminated. The discrete, distinctive land 16 is substantially surrounded by the plurality of discrete elements 20 and the outline 22 of the discrete, distinctive land 16 has a heart-like shape. The aggregation 23 of the remained discrete elements 24 also substantially forms a decorative shape. Herein, "substantially form" means that a plurality of the remained discrete elements aggregate to

form a shape. In the embodiment shown in FIG. 3, the aggregation 23 of the remained discrete elements 24 forms a heart-like shape.

As shown in FIG. 4, the discrete element 20 surrounding the discrete, distinctive land 16 may be partly cut along the line of the desired shape of the discrete, distinctive land 16 (e.g., the outline of the diamond shape in FIG. 4). The fraction 20A of the discrete element 20 partly cut may be remained to form a portion of the background matrix 18. The other fraction of the discrete element 20 partly cut is eliminated to form a discrete, distinctive land 16. Therefore, the number of the discrete element eliminated from the background matrix 20 should include these eliminated fractions of the discrete element 20. Further, the discrete element 24 remained inside the discrete, distinctive land 16 may be partly cut along the line of the desired shape of the aggregation 23 of the remained discrete elements 24 (e.g., the outline of the heart shape in FIG. 4). The fraction 24A of the remained discrete element 24 partly cut may be remained to form a portion of the aggregation 23. The other fraction of the remained discrete element 24 partly cut is eliminated to form a discrete, distinctive land 16. Therefore, the number of the discrete element eliminated also should include these eliminated fractions of the remained discrete element 24. The configuration shown in FIG. 4 is useful to provide more aesthetic clarity.

FIG. 14 shows a schematic view of one embodiment of an embossing process to produce the cellulosic fibrous web of the present invention. The embossing process 500 comprises two rolls 502 and 504. The cellulosic fibrous web 506 is fed into the embossing nip formed between the rolls 502 and 504. The cellulosic fibrous web 506 fed into the embossing nip may comprise a single ply, or two or more plies. In one example, the roll 502 has a pattern of female elements (not shown) on the surface of the roll 502, and the roll 504 has a pattern of male elements (not shown) on the surface of the roll 504. The pattern of the male elements and the pattern of the female elements are arranged to engage each other such that the engagement forms a desired embossing pattern 508 on the cellulosic fibrous web 506. The roll 502 has at least one repeating pattern of the female elements and the roll 504 has at least one repeating male pattern such that one rotation of the rolls 502 and 504 generates at least one repeating pattern of embossing pattern on the cellulosic fibrous web 506. Continuous rotation of the rolls provides a plurality of repeating patterns on the web 506. In a preferred embodiment, the roll 502 has two or more repeating patterns of the female elements and the roll 504 has the same number repeating patterns of the male elements.

The web may be provided a latticework on the entirety of the cellulosic fibrous web. Herein, "latticework" refers to a pattern of small intersecting diagonal or zigzag segments or angles.

The following examples further describe and demonstrate the preferred embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration, and are not to be construed as limitations of the present invention since many variants thereof are possible without departing from its spirit and scope. The same reference number is used for like portions in the drawings. The size of examples shown here is not in actual size. The size of the each element may alter within the scope of the present invention.

Referring to FIG. 1 again, FIG. 1 shows one example of the present invention. The cellulosic fibrous web 12 shown in FIG. 1 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 68 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating 18 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a heart-like shape. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.01 $inch^2$. The discrete, distinctive land 16 has the area of 0.257 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 11.2 % of the area of one repeating pattern.

FIG. 3 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 3 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 48 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating 22 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a heart-like shape. The discrete, distinctive land 16 also has 33 of discrete elements 24 remained inside of the discrete, distinctive land 16, the aggregation of which forms a heart-like shape. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.015 $inch^2$. The discrete, distinctive land 16 has the area of 0.458 $inch^2$.

The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 9.1 % of the area of one repeating pattern.

FIG. 4 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 4 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 57 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating approximately 53 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a diamond shape. The discrete, distinctive land 16 has approximately 21 of discrete elements 24 remained inside of the discrete, distinctive land 16. As shown in FIG. 4, some of the discrete elements 20 are cut along the straight line of each edge of the diamond shape. The fraction 20A remains to form the background matrix 18. Some of the remained discrete elements 24 are also cut along the line of the heart shape. The fraction 24A remains to form the aggregation 23 of the remained discrete element 24. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.012 $inch^2$. The discrete, distinctive land 16 has the area of 0.909 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 21.9 % of the area of one repeating pattern.

FIG. 5 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 5 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 53 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating approximately 52 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a diamond-like shape. The discrete, distinctive land 16 has approximately 21 of discrete elements 24 remained inside of the discrete, distinctive land 16. Some of the remained discrete elements 24 are cut along the line of the heart shape. The fraction 24A remains to form the aggregation 23 of the remained discrete element 24. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.013 $inch^2$. The discrete, distinctive land 16 has the area of 0.98 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 20 % of the area of one repeating pattern.

FIG. 6 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 6 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 48 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating approximately 30 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a circle-like shape. The discrete, distinctive land 16 has approximately 15 of discrete elements 24 remained inside of the discrete, distinctive land 16. Some of the remained discrete elements 24 are cut along the line of the heart shape. The fraction 24A remains to form the aggregation 23 of the remained discrete element 24. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.015 $inch^2$. The discrete, distinctive land 16 has the area of 0.643 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 11.4 % of the area of one repeating pattern.

FIG. 7 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 7 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 44 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating approximately 34 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a rectangle-like shape. The discrete, distinctive land 16 has approximately 15 of discrete elements remained 24 inside of the discrete, distinctive land 16. Some of the remained discrete elements 24 are cut along the line of the heart shape. The fraction 24A remains to form the aggregation 23 of the remained discrete element 24. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.016 $inch^2$. The discrete, distinctive land 16 has the area of 0.777 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 12.9 % of the area of one repeating pattern.

FIG. 8 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 8 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 68 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating

12 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a square-like shape. The discrete, distinctive land 16 has 4 of discrete elements 24 remained inside of the discrete, distinctive land 16. The combination of the square-like shape of the discrete, distinctive land 16 and four of the remained discrete elements 24 forms a flower-like appearance as a whole. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.01 $inch^2$. The discrete, distinctive land 16 has the area of 0.171 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 12 % of the area of one repeating pattern.

FIG. 9 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 9 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 57 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating 12 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a oval-like shape. The discrete, distinctive land 16 has 4 of discrete elements 24 remained inside of the discrete, distinctive land 16. The combination of the oval-like shape of the discrete, distinctive land 16 and four of the remained discrete elements 24 forms a peanut-like appearance as a whole. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.012 $inch^2$. The discrete, distinctive land 16 has the area of 0.206$inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 11.5 % of the area of one repeating pattern.

FIG. 10 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 10 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 84 of discrete elements 20 per square inch. The discrete, distinctive lands 16 comprises two types, first type 16A and second type 16B. The first type 16A of the discrete, distinctive land 16 corresponds to the size eliminating 8 of the discrete elements 20 from the background matrix 18. The second type 16B of the discrete, distinctive land 16 corresponds to the size eliminating 12 of the discrete elements 20 from the background matrix 18. The outline 22A of the first type 16A of the discrete, distinctive land 16 has a rectangle-like shape. The first type 16A of the discrete, distinctive land 16 has 4 of discrete elements 24A remained inside of the

discrete, distinctive land 16. The combination of the rectangle-like shape of the first type 16A of the discrete, distinctive land 16 and four of the remained discrete elements 24 forms a chopsticks-like appearance as a whole. The outline 22B of the second type 16B of the discrete, distinctive land 16 has a oval-like shape. The second type 16B of the discrete, distinctive land 16 has 4 of discrete elements 24B remained inside of the discrete, distinctive land 16. The combination of the oval-like shape of the second type 16B of the discrete, distinctive land 16 and the remained discrete elements 24 forms a peanut-like appearance as a whole. The discrete element 20 has a rain drop shape. The discrete element 20 has the area of 0.008 $inch^2$. The first type 16A of the discrete, distinctive land 16 has the area of 0.091 $inch^2$. The second type 16B of the discrete, distinctive land 16 has the area of 0.137 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 7.8 % of the area of one repeating pattern.

FIG. 11 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 11 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 48 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating approximately 32 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a diamond shape. The discrete, distinctive land 16 has approximately 21 of discrete elements 24 remained inside of the discrete, distinctive land 16. As shown in FIG. 11, some of the discrete elements 20A are cut along the straight line of each edge of the diamond shape. Some of the remained discrete elements 24 are also cut along the line of the heart shape. The discrete element 20 has a rain drop shape. The fraction 24A remains to form the aggregation 23 of the remained discrete element 24. The discrete element 20 has the area of 0.015 $inch^2$. The discrete, distinctive land 16 has the area of 0.686 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 12.1 % of the area of one repeating pattern. The cellulosic fibrous web shown in FIG. 11 also has a lattice work. Each cell of the lattice work has one discrete, distinctive land 16 therein.

FIG. 12 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 12 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 60.5 of discrete

elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating 25 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a diamond-like shape. The discrete element 20 has a bow tie shape. The discrete element 20 has the area of 0.012 $inch^2$. The discrete, distinctive land 16 has the area of 0.413 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 21.9 % of the area of one repeating pattern.

FIG. 13 shows another example of the present invention. The cellulosic fibrous web 12 shown in FIG. 13 has an embossing pattern. One repeating pattern 14 comprises a plurality of discrete, distinctive lands 16 and a background matrix 18 having a plurality of discrete elements 20. The background matrix 18 has a density of 42 of discrete elements 20 per square inch. The discrete, distinctive land 16 corresponds to the size eliminating 22 of the discrete elements 20 from the background matrix 18. The outline 22 of the discrete, distinctive land 16 surrounded by a plurality of the discrete elements 20 has a cross-like shape. The discrete element 20 has a trident shape. The discrete element 20 has the area of 0.017 $inch^2$. The discrete, distinctive land 16 has the area of 0.534 $inch^2$. The total area of the discrete, distinctive lands 16 in one repeating pattern 14 occupies 27.2 % of the area of one repeating pattern.

All of these examples provide the benefits of the present invention.

The disclosures of all patents, patent applications (and any patents which issue thereon, as well as any corresponding published foreign patent applications), and publications mentioned throughout this patent application are hereby incorporated by reference herein. It is expressly not admitted, however, that any of the documents incorporated by reference herein teach or disclose the present invention. It is also expressly not admitted that any of the commercially available materials or products described herein teach or disclose the present invention.

It should also be understood that all of the limits and ranges specified herein include all narrower ranges, limits, and amounts that are within the specified limits and ranges and that such narrower ranges and limits may be claimed even though those limits and ranges are not separately listed.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A cellulosic fibrous web having an embossing pattern, wherein

the embossing pattern comprises a repeating pattern, one repeating pattern comprises a plurality of discrete, distinctive lands and a background matrix having a plurality of discrete elements, wherein the repeating pattern is provided by embossing the cellulosic fibrous web,

the background matrix has a density of from 40 to 90 of the discrete elements per square inch, and

the discrete, distinctive land is defined by being substantially surrounded by the discrete elements of the background matrix, one discrete, distinctive land corresponds to the size eliminating from 4 to 90 of the discrete elements from the background matrix, and the total area of the discrete, distinctive lands in one repeating pattern occupies from 3 % to 35 % of the area of one repeating pattern.

2. The cellulosic fibrous web of Claim 1 wherein the discrete, distinctive land has an outline defined by being substantially surrounded by the discrete elements of the background matrix, and the outline of the discrete, distinctive land has a decorative shape.

3. The cellulosic fibrous web of Claim 2 wherein at least one discrete element surrounding the discrete, distinctive land is partly eliminated to form the discrete, distinctive land.

4. The cellulosic fibrous web of Claim 3 wherein the discrete, distinctive land has at least one discrete element remained inside of the land.

5. The cellulosic fibrous web of Claim 4 wherein the aggregation of the plurality of remained discrete elements substantially forms a decorative shape.

6. The cellulosic fibrous web of Claim 5 wherein at least one remained discrete element is partly eliminated to form the discrete, distinctive land.

7. The cellulosic fibrous web of Claim 1 wherein the discrete element and the discrete, distinctive land are of relatively different levels in height.

8. The cellulosic fibrous web of Claim 7 wherein the discrete element is embossed, and the discrete, distinctive land is unembossed.

9. The cellulosic fibrous web of Claim 7 wherein the discrete element is unembossed, and the discrete, distinctive land is embossed.

10. The cellulosic fibrous web of Claim 1 wherein the discrete element has the area of from 0.006 $inch^2$ to 0.024 $inch^2$.

11. The cellulosic fibrous web of Claim 10 wherein the discrete element has the area of from 0.009 $inch^2$ to 0.020 $inch^2$.

12. The cellulosic fibrous web of Claim 11 wherein the discrete element has the area of from 0.010 $inch^2$ to 0.017 $inch^2$.

13. The cellulosic fibrous web of Claim 1 wherein the discrete, distinctive land has the area of from 0.025 $inch^2$ to 3.3 $inch^2$.

14. The cellulosic fibrous web of Claim 13 wherein the discrete, distinctive land has the area of from 0.076 $inch^2$ to 2.6 $inch^2$.

15. The cellulosic fibrous web of Claim 14 wherein the discrete, distinctive land has the area of from 0.125 $inch^2$ to 2.2 $inch^2$.

16. The cellulosic fibrous web of Claim 1 wherein the background matrix has a density of from 45 to 80 of the discrete elements per square inch.

17. The cellulosic fibrous web of Claim 16 wherein the background matrix has a density of from 50 to 70 of the discrete elements per square inch.

18. The cellulosic fibrous web of Claim 1 wherein one discrete, distinctive land corresponds to the size eliminating from 8 to 70 of the discrete elements from the background matrix.

19. The cellulosic fibrous web of Claim 18 wherein one discrete, distinctive land corresponds to the size eliminating from 10 to 60 of the discrete elements from the background matrix.

20. The cellulosic fibrous web of Claim 1 wherein the total area of the discrete, distinctive lands in one repeating pattern occupies from 6 % to 28 % of the area of one repeating pattern.

21. The cellulosic fibrous web of Claim 20 wherein the total area of the discrete, distinctive lands in one repeating pattern occupies from 10 % to 24 % of the area of one repeating pattern.

22. The cellulosic fibrous web of Claim 1 wherein the cellulosic fibrous web is wound in roll.

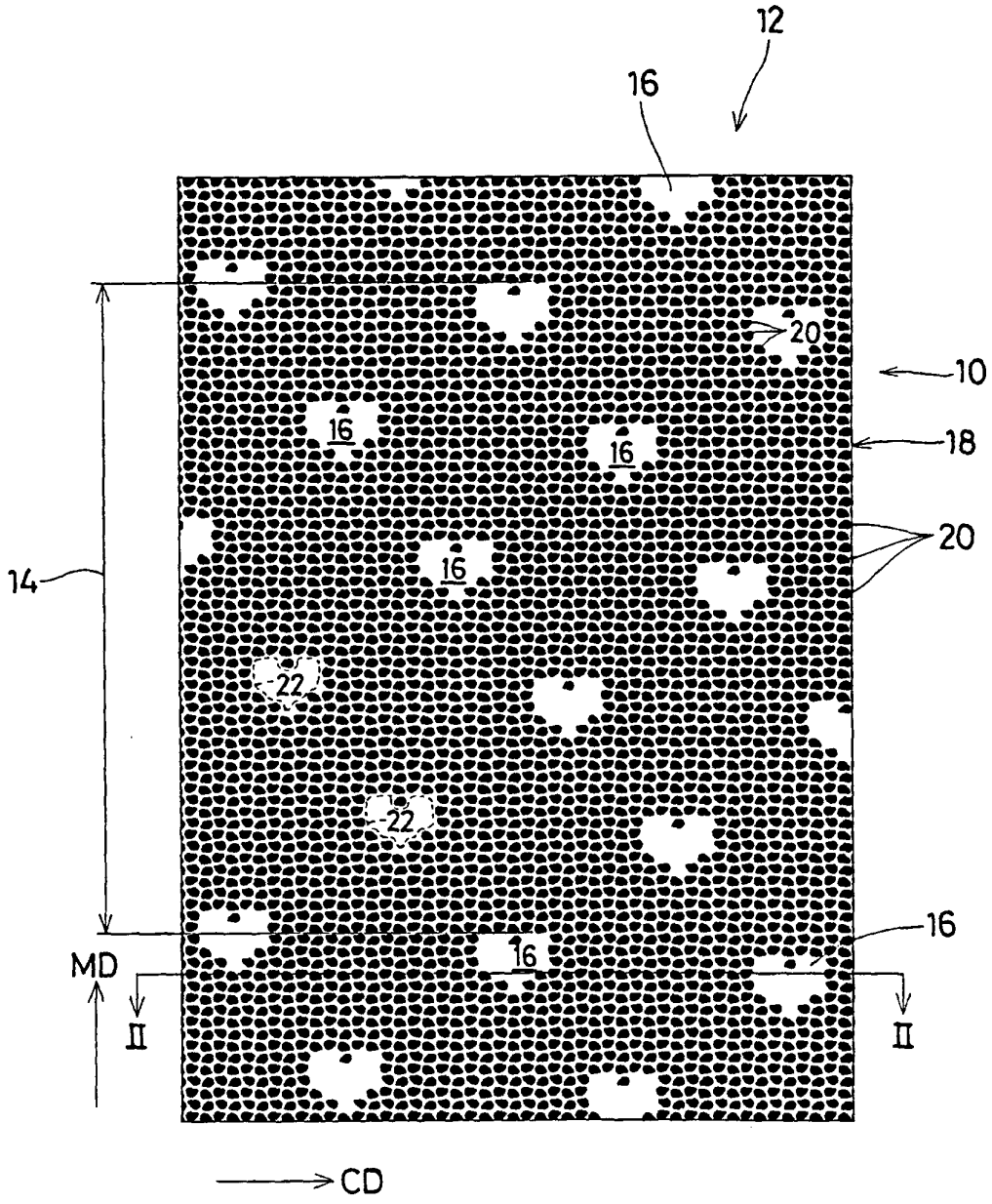

FIG. 1

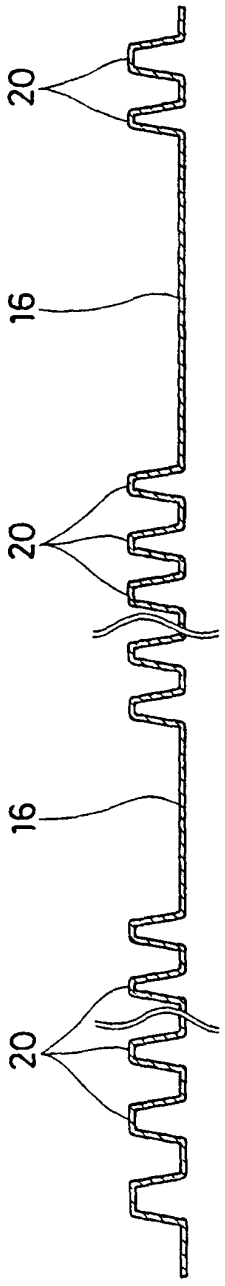

FIG. 2

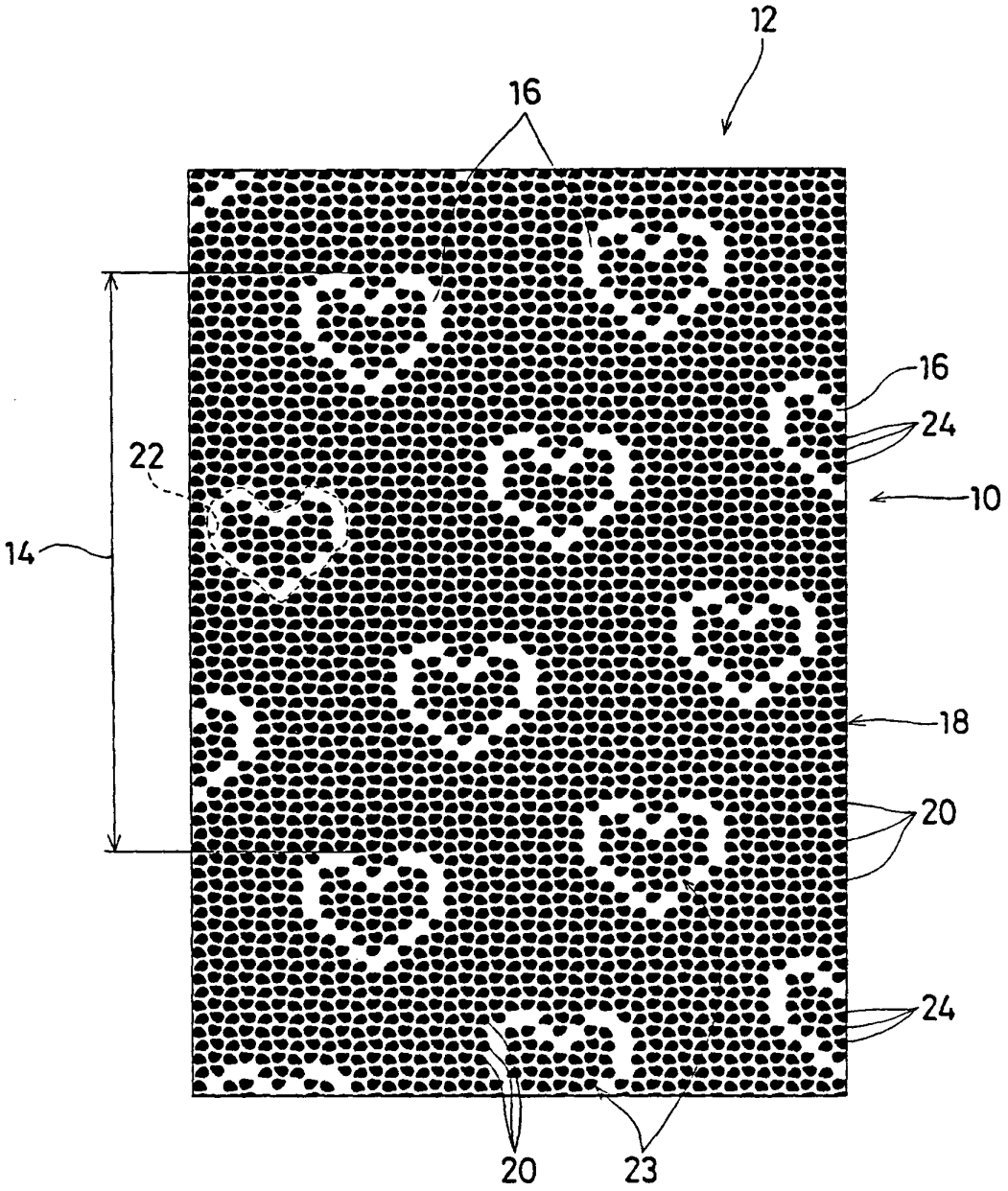

FIG. 3

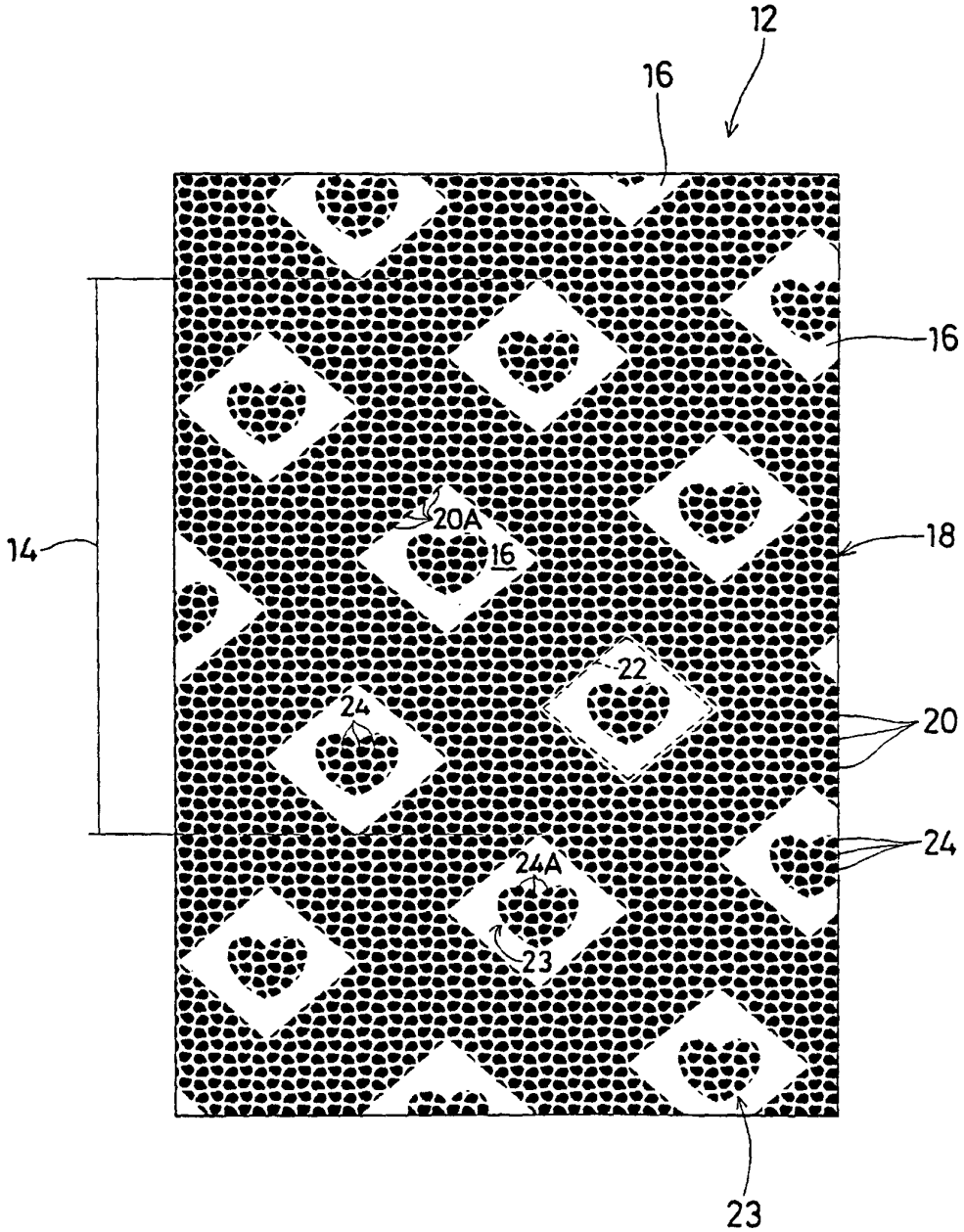

FIG. 4

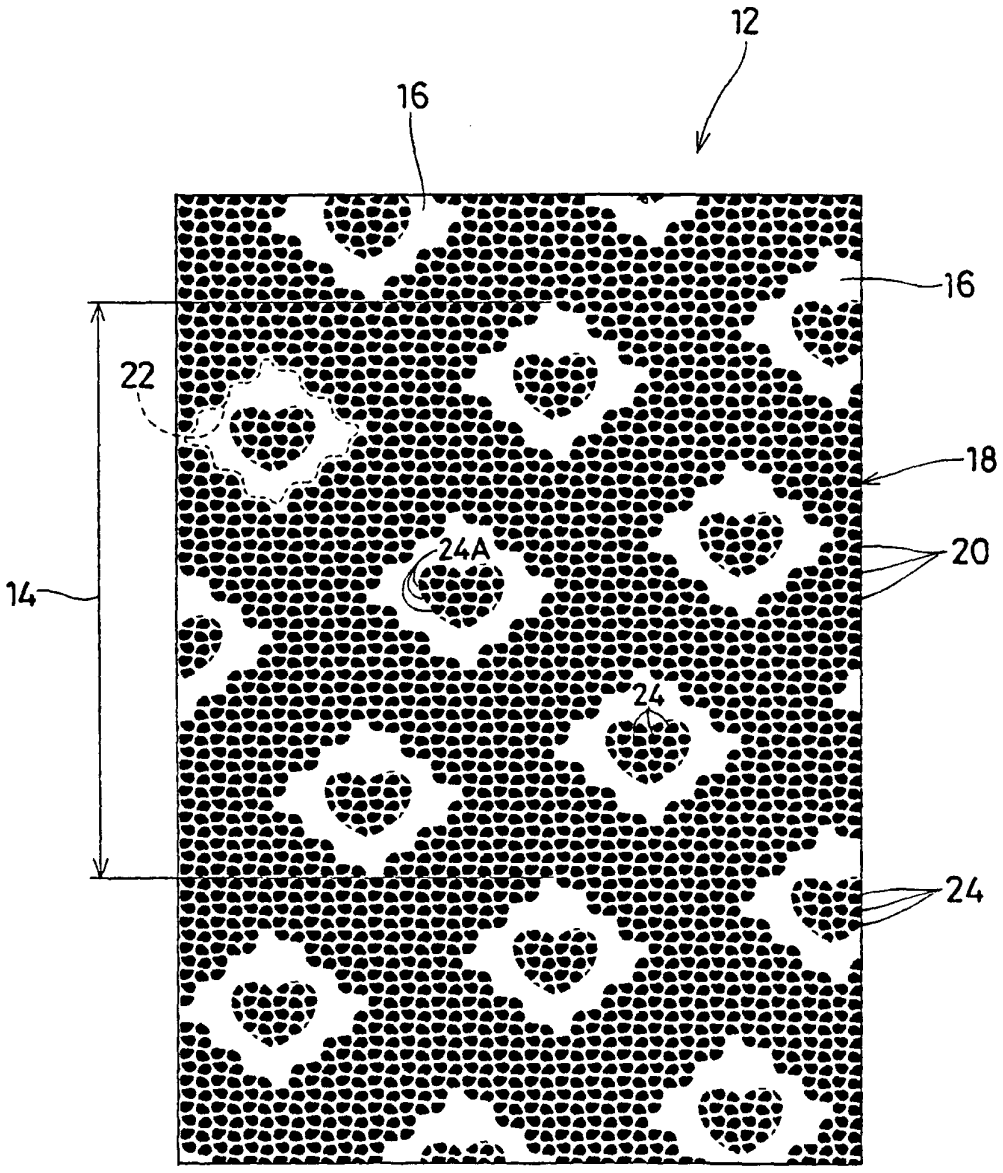

FIG. 5

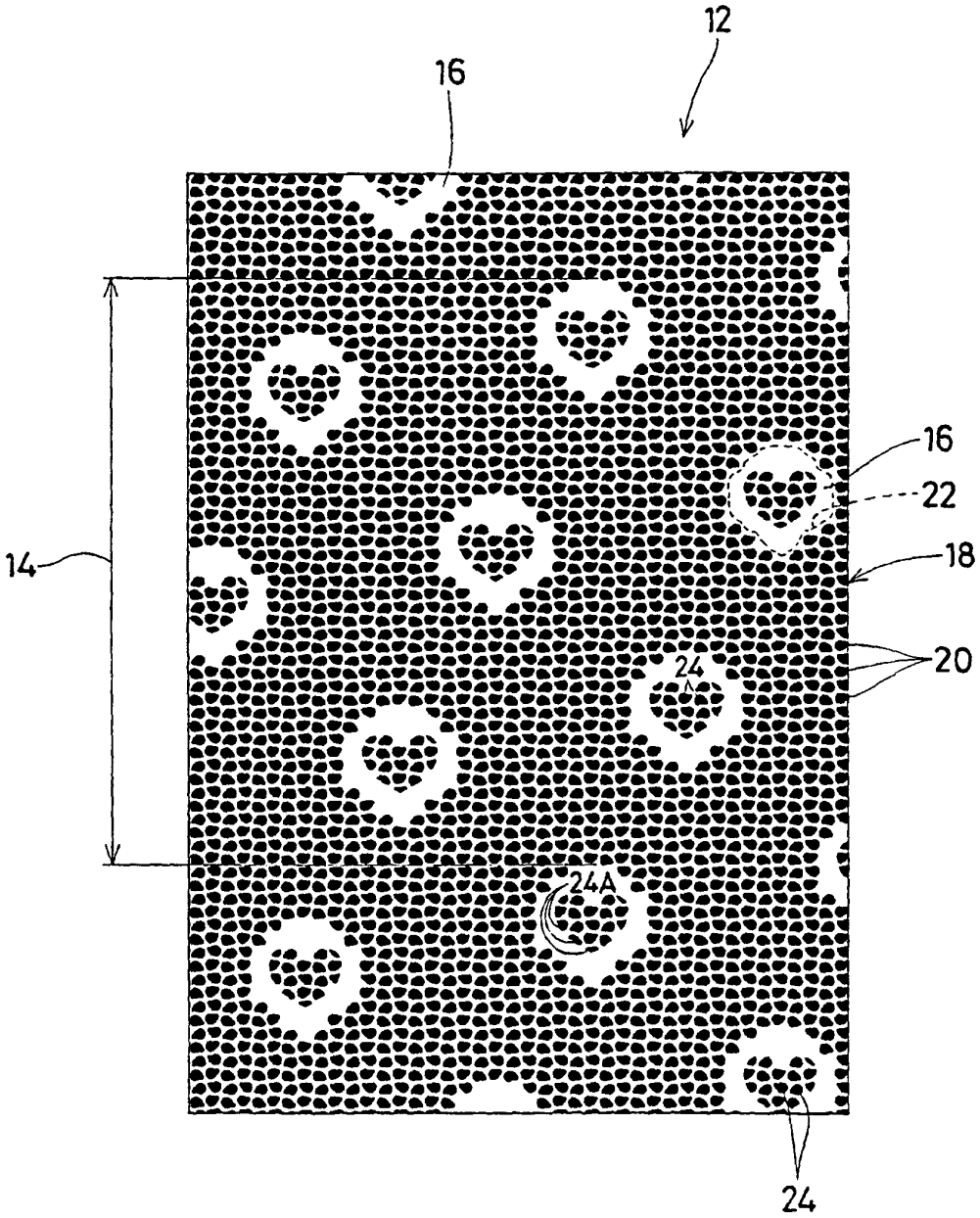

FIG. 6

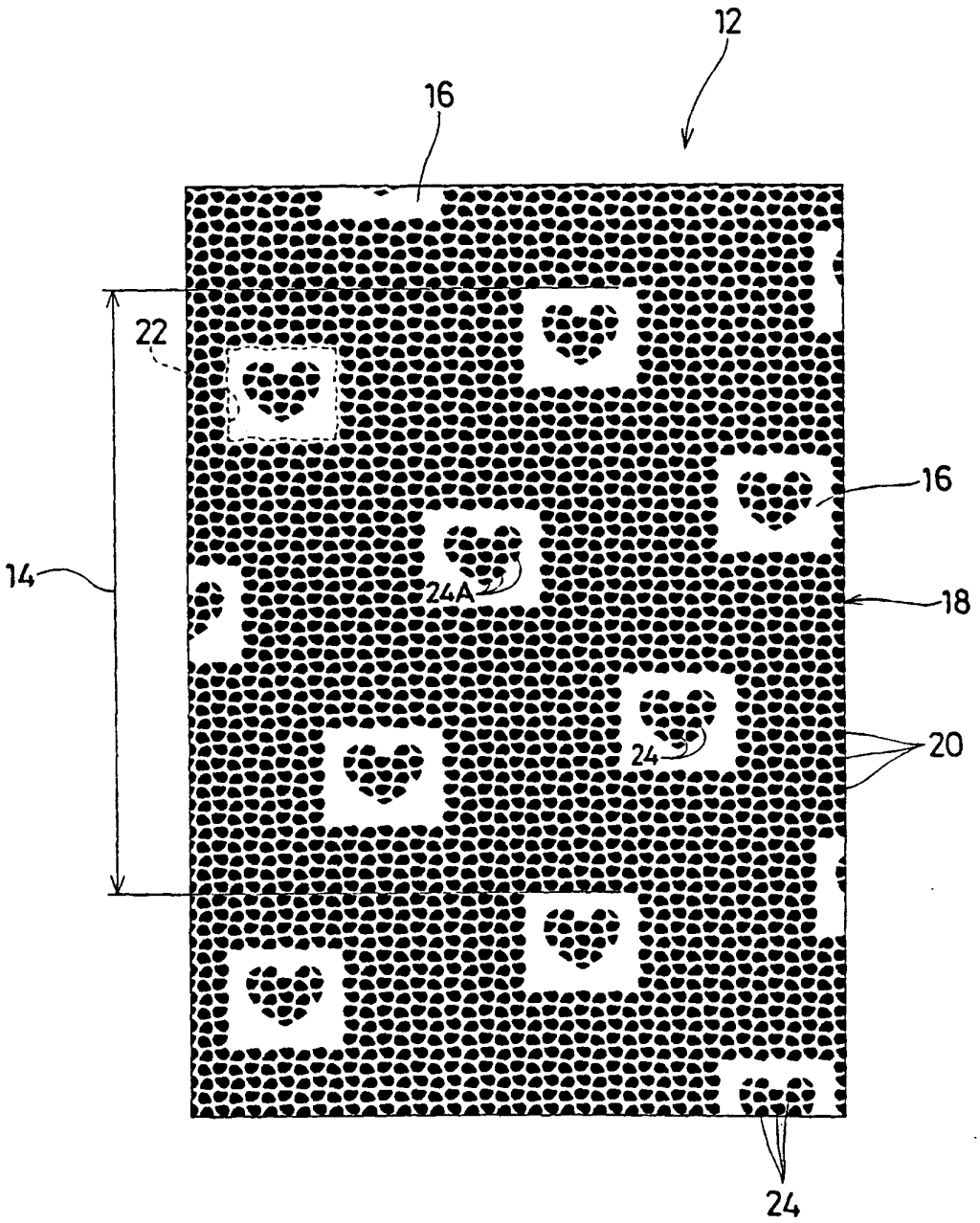

FIG. 7

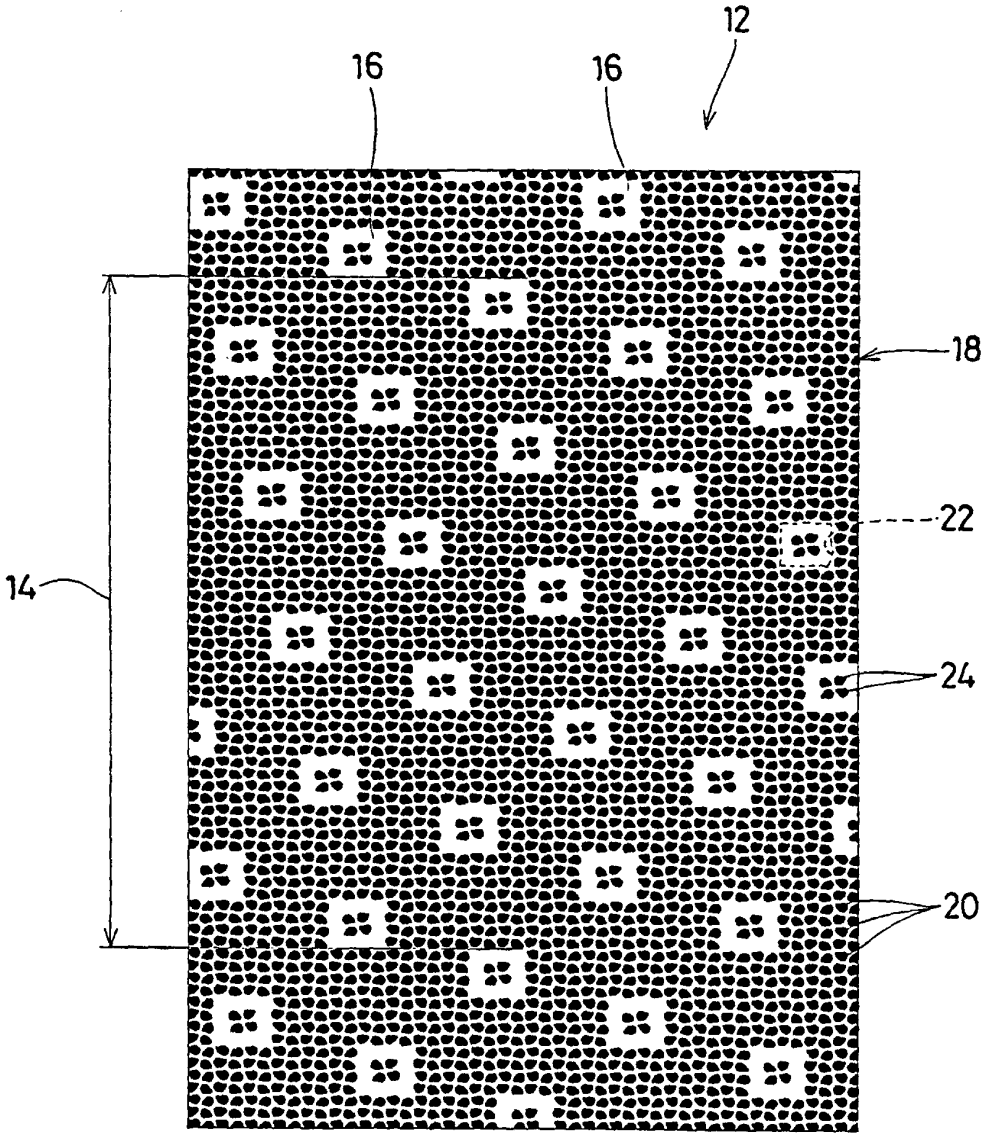

FIG. 8

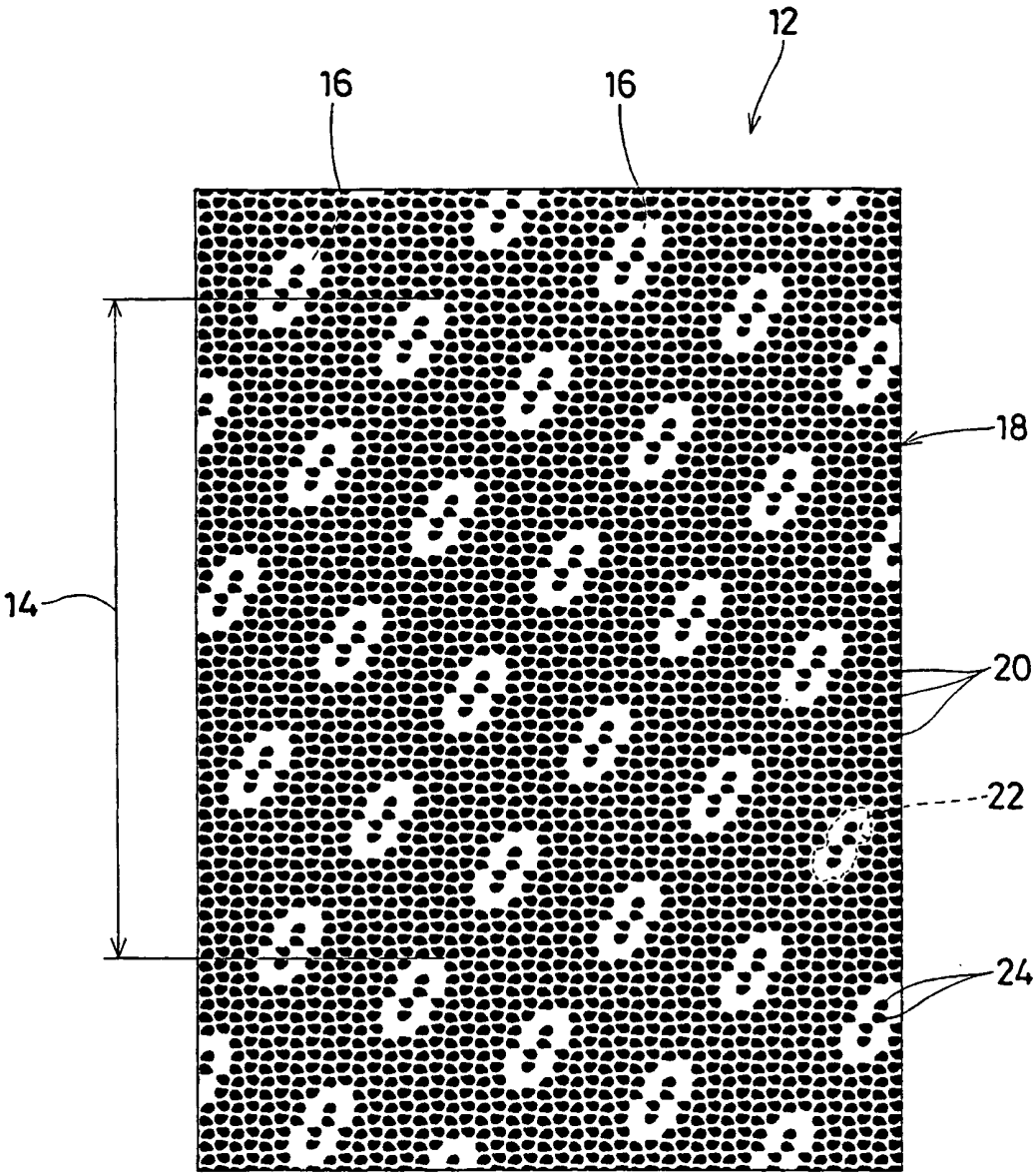

FIG. 9

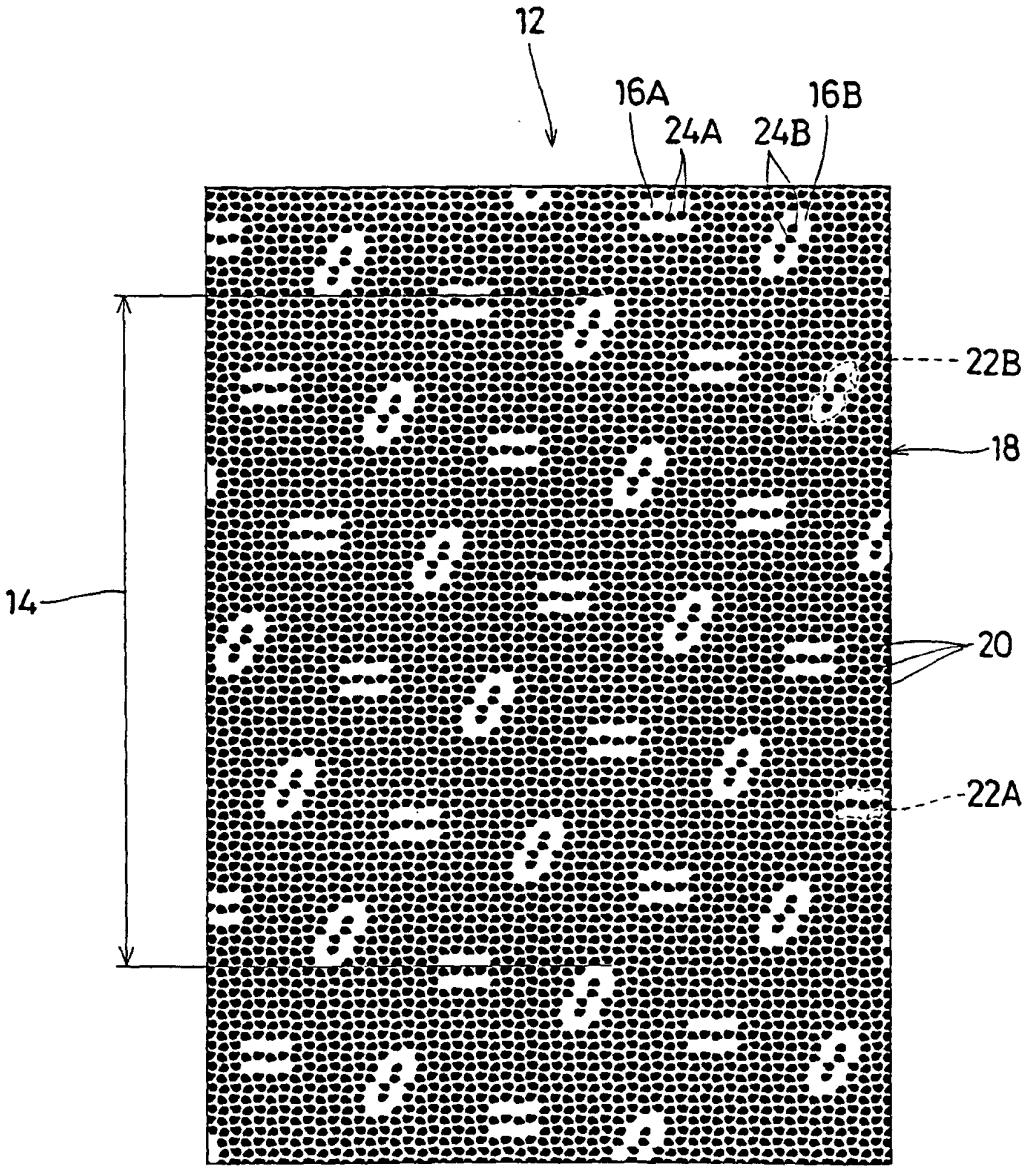

FIG. 10

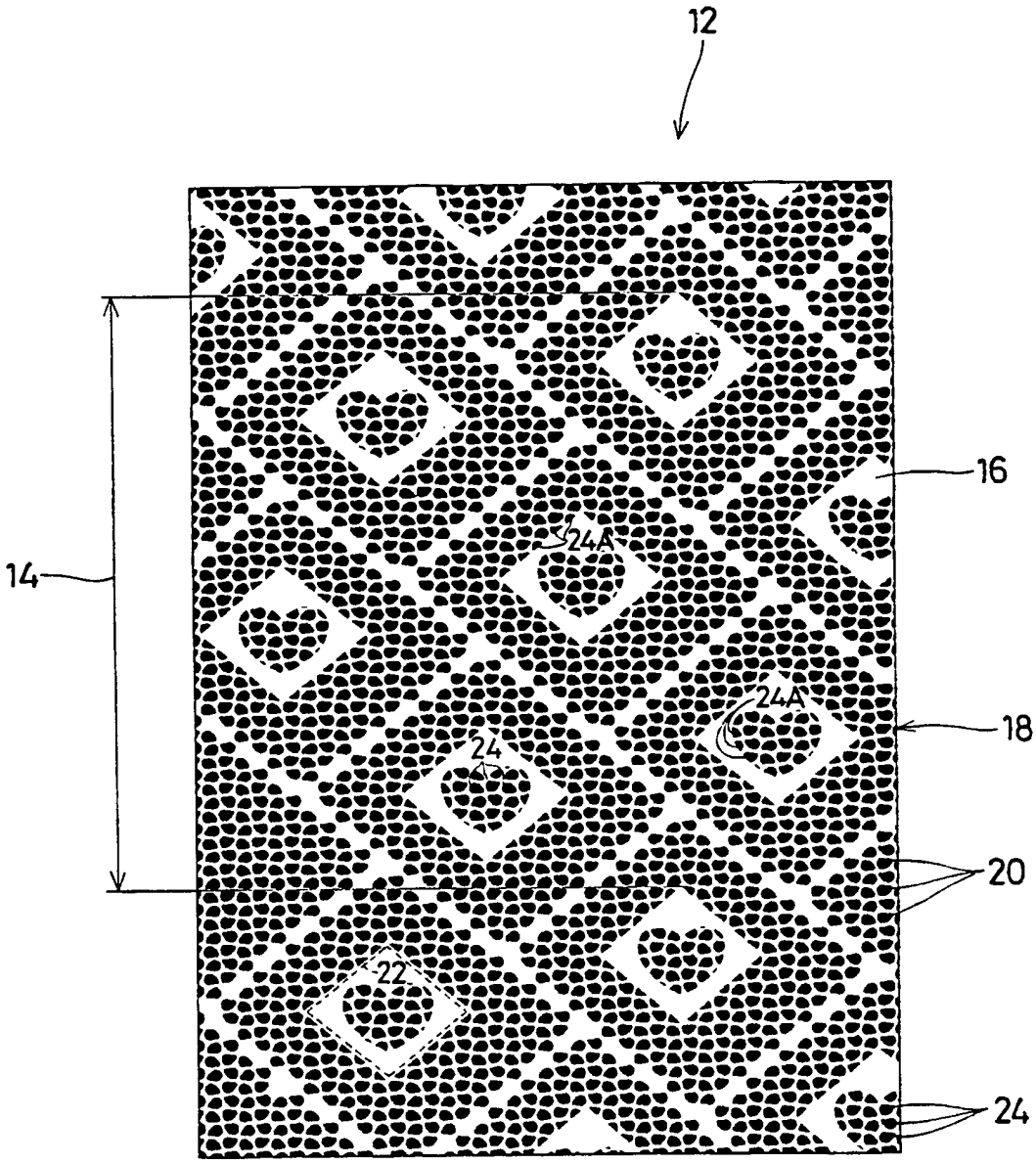

FIG. 11

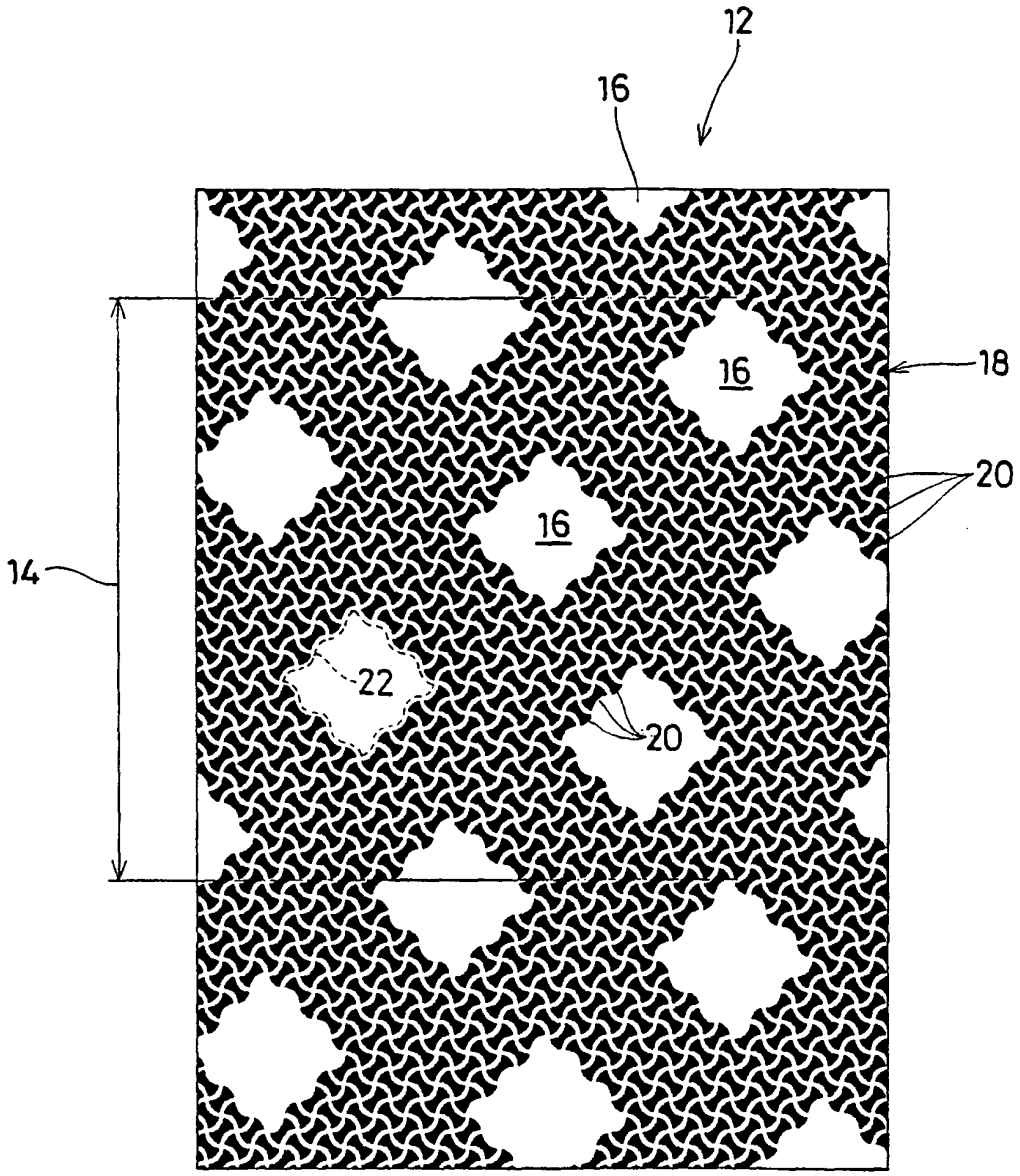

FIG. 12

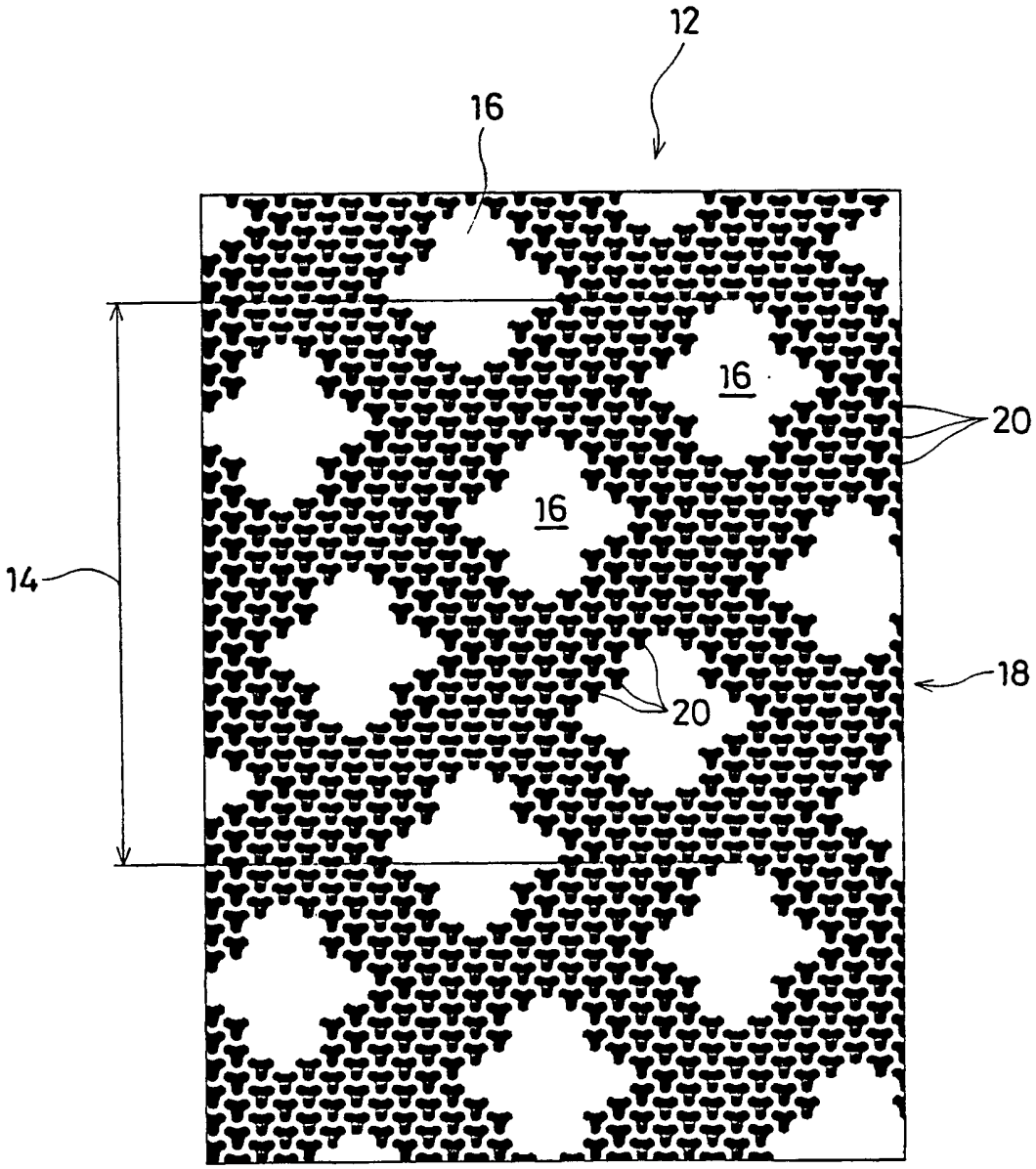

FIG. 13

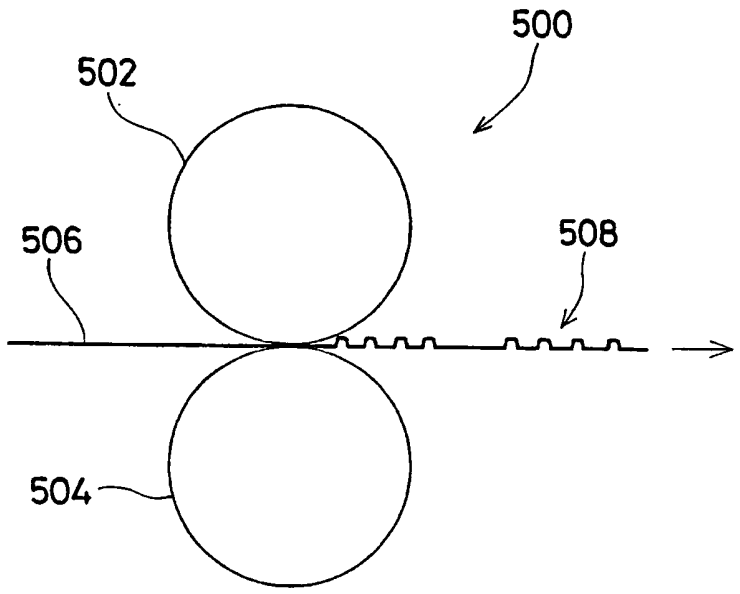

FIG. 14

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/11779

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D21H27/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D21H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 721 251 A (KAYSERSBERG SA) 22 December 1995 (1995-12-22) page 3, line 37 - line 38 page 4, line 7 - line 23 figure 2	1-3,7, 13-15,22
A	US 4 759 967 A (BAUERNFEIND ROBERT N) 26 July 1988 (1988-07-26) cited in the application the whole document	1-22
A	FR 2 728 152 A (KAYSERSBERG SA) 21 June 1996 (1996-06-21) page 7, line 11 -page 8, line 5 figure 3	1-22

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 February 2000	23/02/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Songy, O

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INTERNATIONAL SEARCH REPORT

information on patent family members

Inte nal Application No
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